

CLAIMS

1. A method for managing torque in a hybrid electric vehicle with a displacement on demand (DOD) internal combustion engine (ICE), an electric machine and a battery, comprising:
 - operating the ICE in an activated mode;
 - 5 transitioning the ICE from the activated mode to a deactivated mode; and
 - smoothing disturbances in ICE torque during the deactivation transition using the electric machine.
2. The method of claim 1 wherein the step of smoothing disturbances comprises generating electricity from excess ICE torque when the ICE torque is greater than a desired torque.
3. The method of claim 2 further comprising storing the electricity in the battery.
4. The method of claim 1 wherein the step of smoothing disturbances comprises using the electric machine to supply torque when the ICE torque is less than a desired torque.
5. The method of claim 1 further comprising:
 - transitioning the ICE from the deactivated mode to the activated mode; and
 - smoothing disturbances in ICE torque during the
 - 5 reactivation transition using the electric machine.
6. The method of claim 5 wherein the step of smoothing disturbances comprises using the electric machine to supply torque when the ICE torque is less than a desired torque.

7. The method of claim 5 wherein the step of smoothing disturbances comprises generating electricity from excess ICE torque when the ICE torque is greater than a desired torque.

8. The method of claim 7 wherein the electricity is stored in the battery.

A method for managing torque in a hybrid electric vehicle with a displacement on demand (DOD) internal combustion engine (ICE), an electric machine and a battery, comprising:

- 5 operating the ICE in a deactivated mode;
 transitioning the ICE from the deactivated mode to an activated mode; and
 smoothing disturbances in ICE torque during the
10 reactivation transition using the electric machine.

9. The method of claim 9 wherein the step of smoothing disturbances comprises using the electric machine to supply torque when the ICE torque is less than a desired torque.

10. The method of claim 9 wherein the step of smoothing disturbances comprises using the electric machine to generate electricity from excess ICE torque when the ICE torque is greater than a desired torque.

11. The method of claim 11 wherein the electricity is stored in the battery.

12. The method of claim 9 further comprising:
 transitioning the ICE from the activated mode to the deactivated mode; and

smoothing disturbances in ICE torque during the
5 deactivation transition using the electric machine.

13. The method of claim 13 wherein the step of smoothing disturbances in ICE torque comprises using the electric machine to supply torque when the ICE torque is less than a desired torque.

15. The method of claim 13 wherein the step of smoothing disturbances comprises using the electric machine to generate electricity from excess ICE torque when the ICE torque is greater than a desired torque.

16. The method of claim 15 wherein the electricity is stored in the battery.

17. A torque management system for a hybrid electric vehicle with a displacement on demand (DOD) internal combustion engine (ICE) that operates in activated and deactivated modes, comprising:

an electric machine; and
5 a torque management module that smoothes disturbances in ICE torque using the electric machine during DOD mode transitions.

18. A torque management system of claim 17 wherein the torque management module smoothes disturbances during transitions from the deactivated mode to the activated mode.

19. A torque management system of claim 18 wherein the torque management module commands the electric machine to generate torque when the displacement on demand ICE first transitions to the activated mode.

20. A torque management system of claim 17 wherein the torque management module commands the electric machine to smooth disturbances during transitions from the activated mode to the deactivated mode.

21. The torque management system of claim 20 wherein the torque management module commands the electric machine to generate torque shortly after the displacement on demand ICE enters the deactivated mode.

22. The torque management system of claim 20 wherein the torque management module commands the electric machine to generate electricity from ICE torque when the ICE enters the deactivated mode.

23. The torque management system of claim 18 wherein the torque management module commands the electric machine to generate electricity from ICE torque shortly after entering the activated mode.

24. A torque management system of claim 17 further comprising:

an inverter that is connected to the electric machine; and
at least one battery that is connected to the inverter.

25. A torque management system of claim 24 wherein the battery can be at least one of lead acid batteries, lithium ion batteries, and lithium polymer batteries.

26. A torque management system of claim 17 wherein the torque management module commands the electric machine to smooth disturbances in ICE torque when the ICE torque is not equal to a desired torque.